US007922408B2

(12) **United States Patent**
Daisuke

(10) **Patent No.: US 7,922,408 B2**
(45) **Date of Patent: Apr. 12, 2011**

(54) **PRINTER WITH BELT TENSIONING UNIT**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 582 days.

(21) Appl. No.: **11/939,887**

(22) Filed: **Nov. 14, 2007**

(65) **Prior Publication Data**

US 2008/0193184 A1 Aug. 14, 2008

(30) **Foreign Application Priority Data**

Feb. 9, 2007 (JP) 2007-030697

(51) **Int. Cl.**
B41J 17/08 (2006.01)

(52) **U.S. Cl.** **400/236**; 400/223; 347/215

(58) **Field of Classification Search** 400/223, 400/234, 236; 347/215
See application file for complete search history.

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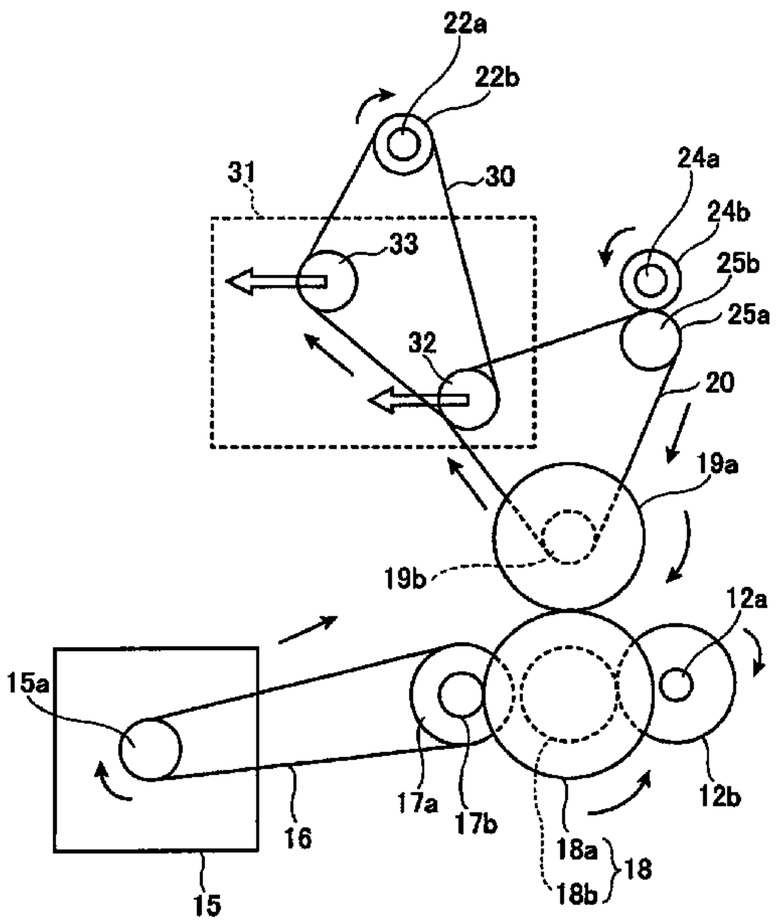
(57) **ABSTRACT**

A thermal transfer printer having a configuration in which a drive power of one motor is transmitted to a platen roller and a ribbon conveying mechanism can be easily assembled. The printer has: (a) a printing medium feed reel, (b) a ribbon feed reel, (c) a platen roller, (d) a thermal head, (e) a ribbon conveying roller, (f) a ribbon take-up reel, (g) a motor that drives the platen roller, (h) a rotary drive mechanism that transmits a drive power of the motor to the ribbon conveying roller via a first belt and transmits a drive power of the motor to the ribbon take-up reel via the first belt and a second belt, and (i) a tension unit comprising a plurality of pulleys that are in contact with the first and second belts and rotate following the movement thereof, a plurality of elastic members that adjust positions of the plurality of pulleys so as to apply tension to the first and second belts, and a plurality of fixing members that fix the positions of the plurality of pulleys.

3 Claims, 3 Drawing Sheets



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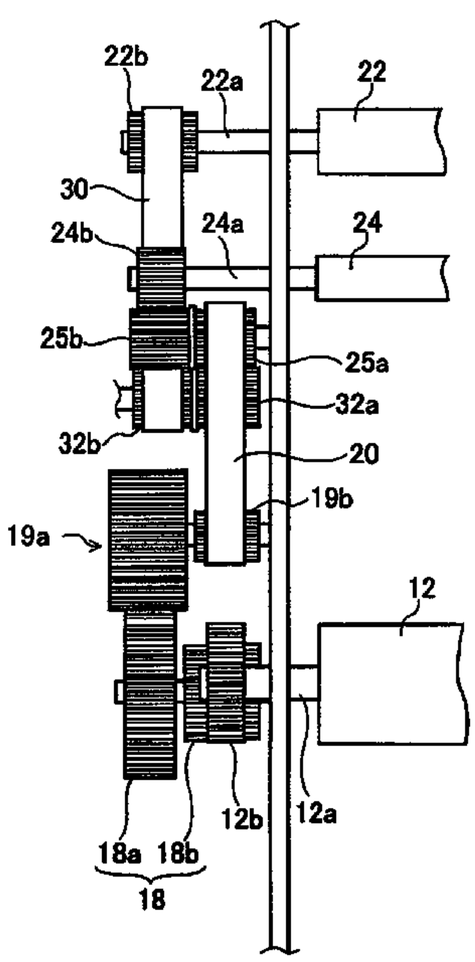

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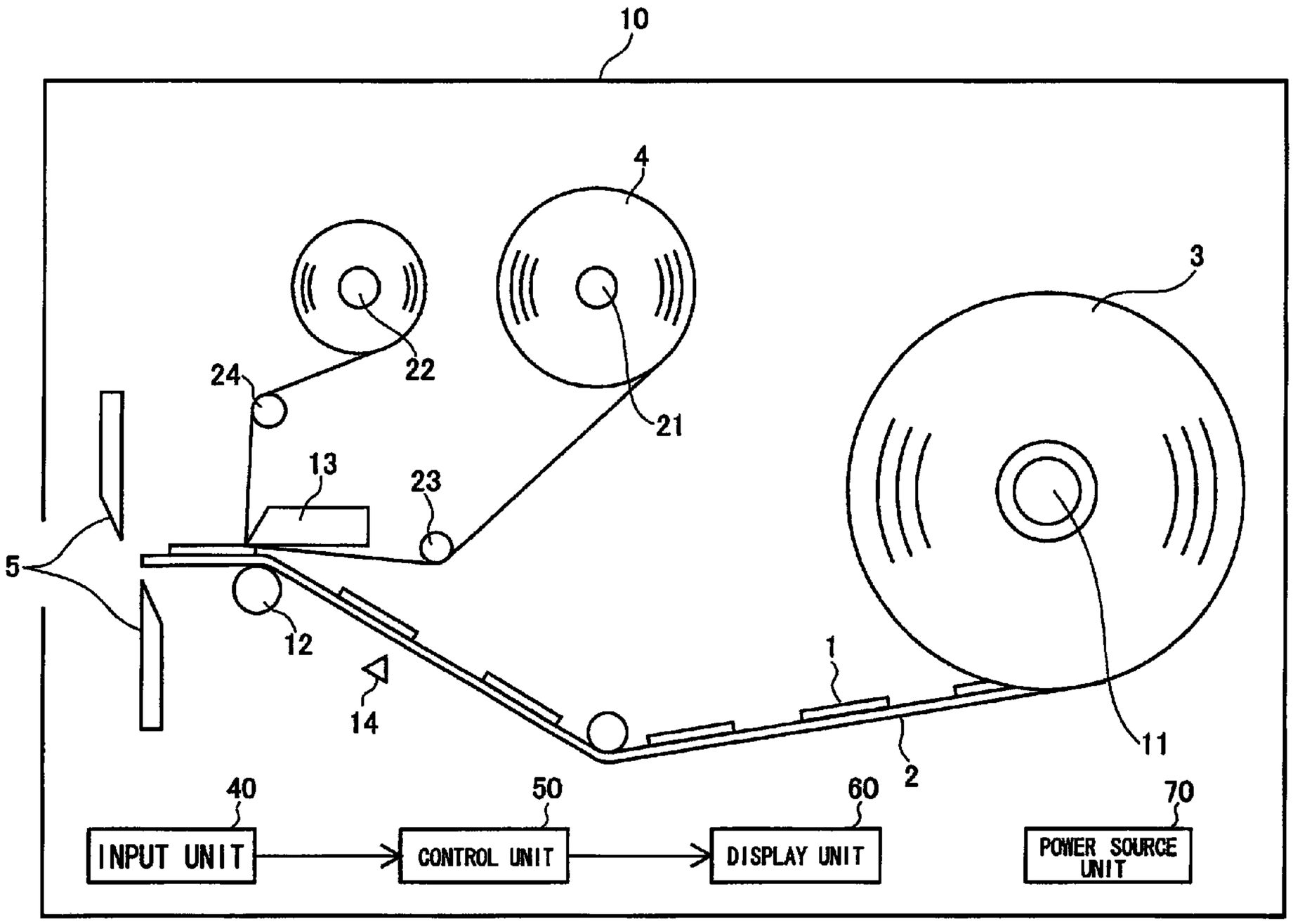
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4
22
24
21
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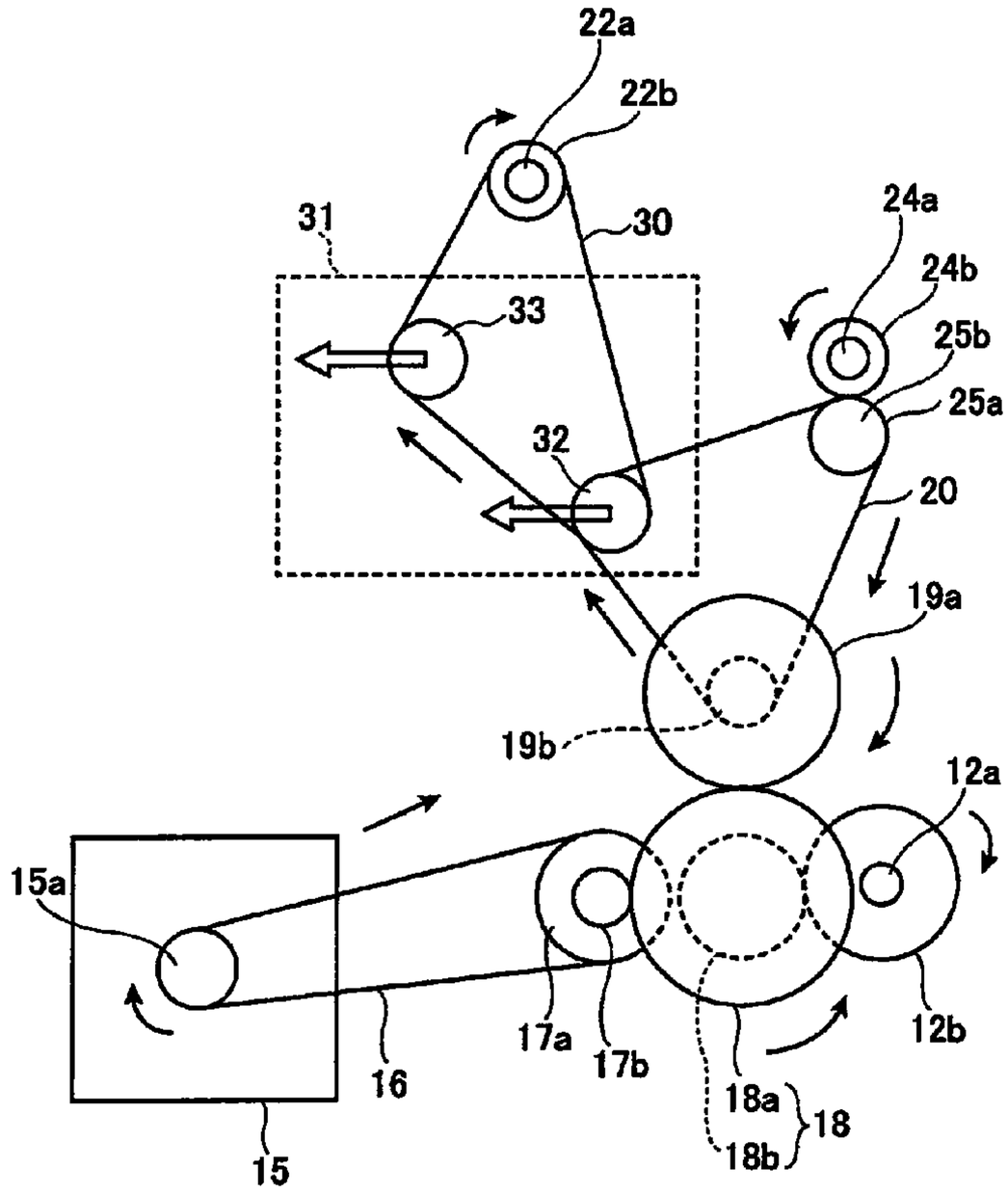
50
60
70
INPUT UNIT
CONTROL UNIT
DISPLAY UNIT
POWER SOURCE UNIT

Fig. 1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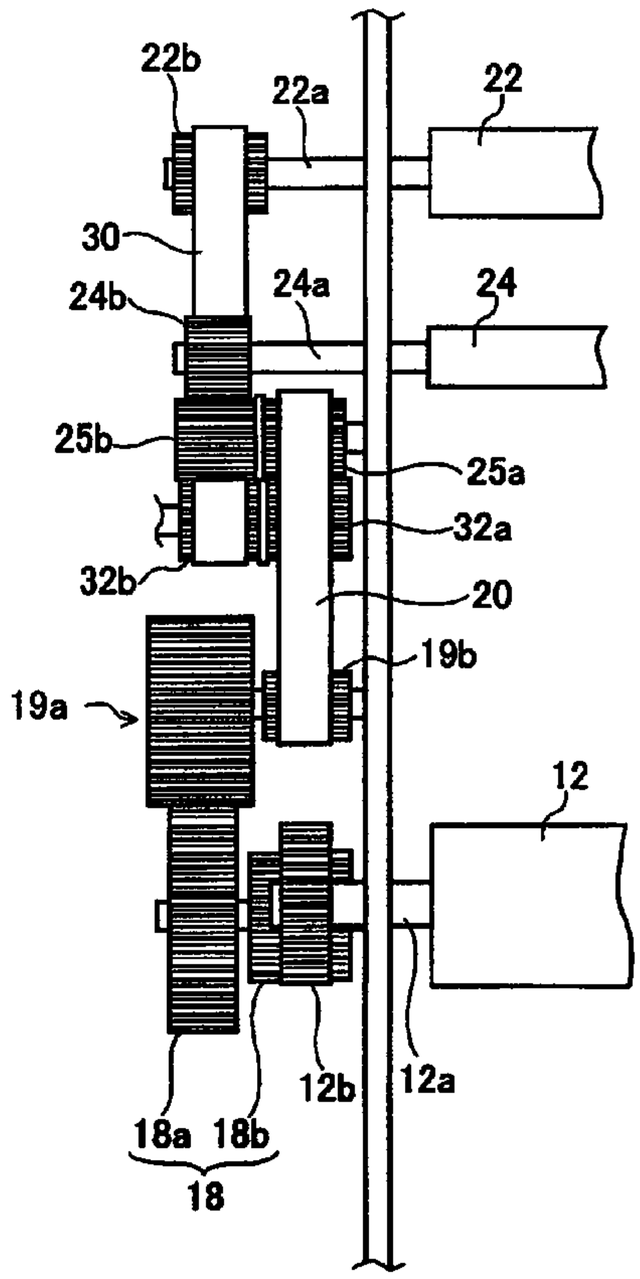
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(b)

Fig. 2

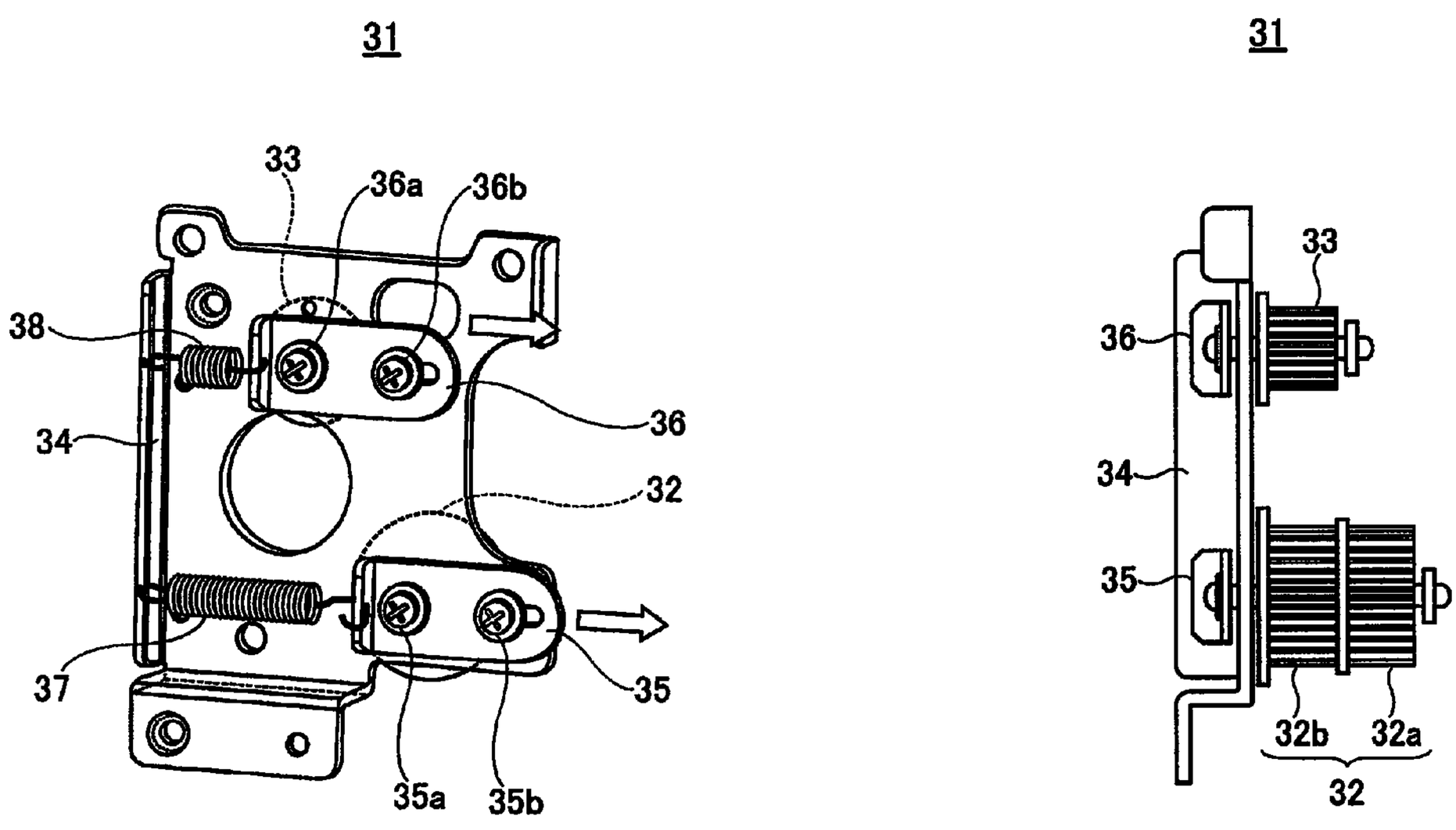

Fig. 3

PRINTER WITH BELT TENSIONING UNIT

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a printer that performs printing by transferring ink of an ink ribbon onto a printing medium by using a thermal head.

2. Description of the Related Art

Thermal transfer printers in which printing is performed by transferring ink of an ink ribbon onto a printing medium by using a thermal head have been used as printers for printing on printing media such as labels attached to a mounting paper and band-shaped sheets for tag fabrication. In thermal transfer printers, the printing is performed by transferring ink of an ink ribbon onto a printing medium by heat generated by a heat-generating body of a thermal head, while intermittently conveying the printing medium and the ink ribbon in the same direction and at the same speed.

Accordingly, a thermal transfer printer is provided with a platen roller that conveys the printing medium and ink ribbon and also with a ribbon conveying mechanism that is composed of a ribbon feed reel, a ribbon conveying roller, and a ribbon take-up reel. However, if the platen roller and the ribbon conveying mechanism are driven with separate motors, the motors are difficult to control and the cost rises. Therefore, a configuration can be considered in which the drive power of one motor is transmitted to both the platen roller and the ribbon conveying mechanism by using a timing belt and gears.

In belt drive mechanisms in which a drive power of a drive pulley is transmitted to a driven pulley via a timing belt, an idle pulley for adjusting the tension of the timing belt is disposed between the drive pulley and driven pulley, and if a belt drive mechanism of a multistage system is used, the number of idle pulleys has to be equal to the number of timing belts. As a result, the number of parts is increased, a space is required for disposing the parts, and the belt drive mechanism is difficult to assembly. Furthermore, the tension of the timing belt has to be measured by using an adjustment tool such as a push gage in order to adjust and verify the tension of the timing belt.

As a pertinent technology, Japanese Patent Application Laid-open No. 2002-200809 (page 1, FIG. 1) discloses a printer having a timing belt that transmits a drive power from a drive source (pulse motor) to a platen roller and a conveying roller, and a first tension member (tension roller) and a second tension member (tension pulley) that apply tension to the timing belt, this printer comprising a rotary member that rotatably holds any one tension member. With such a structure an error in tension occurring when only one tension member (tension roller) is used to rotate two rollers by a drive power of one motor can be eliminated and uniform tension can be obtained along the entire circumference of the timing melt. However, a space is required to arrange the two tension members, and the printer is difficult to assembly.

SUMMARY OF THE INVENTION

The present invention was created with the foregoing in view. It is an object of the present invention to save space and facilitate the assembly of a printer that performs printing by transferring ink of an ink ribbon onto a printing medium by using a thermal head, while employing a configuration that transfers a drive power of one motor to a platen roller and a ribbon conveying mechanism.

To attain the above-described object, the present invention in one gist thereof provides a printer comprising: (a) a printing medium feed reel that feeds a printing medium, (b) a ribbon feed reel that feeds an ink ribbon, (c) a platen roller that conveys the printing medium that is fed from the printing medium feed reel and the ink ribbon that is fed from the ribbon feed reel, (d) a thermal head that is disposed opposite the platen roller via the printing medium and the ink ribbon and performs printing by transferring ink of the ink ribbon onto the printing medium, (e) a ribbon conveying roller for conveying the ink ribbon that has been used for printing, (f) a ribbon take-up reel that takes up the ink ribbon that is conveyed by the ribbon conveying roller, (g) a motor that drives the platen roller, (h) a rotary drive mechanism that transmits a drive power of the motor to the ribbon conveying roller via at least a first belt and transmits a drive power of the motor to the ribbon take-up reel via at least the first belt and a second belt, and (i) a tension unit comprising a plurality of pulleys that are in contact at least with the first belt and second belt and rotate following the movement thereof, a plurality of elastic members that adjust positions of the plurality of pulleys so as to apply tension at least to the first belt and second belt and a plurality of fixing members that fix the positions of the plurality of pulleys.

In accordance with the present invention, by using the tension unit that can adjust the tension applied at least to the first belt and the second belt that transmit the drive power of the motor to the ribbon conveying roller and the ribbon take-up reel, the space can be saved and printer assembling can be facilitated.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic drawing illustrating the structure at the right side surface of the printer of one embodiment of the present embodiment;

FIG. **2** is a schematic drawing illustrating a rotary drive mechanism and a tension unit of the printer of one embodiment of the present invention; and

FIG. **3** shows a detailed structure of the tension unit.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The best mode for carrying out the present invention will be described below in greater detail with reference to the appended drawings. Identical structural elements will be assigned with identical reference numerals and explanation thereof will be omitted.

FIG. **1** is a schematic drawing illustrating the structure at the right side surface of the printer of one embodiment of the present embodiment. This printer performs printing on printing media such as labels attached to a mounting paper and band-shaped sheets for tag fabrication, and the printing is carried out by transferring ink of an ink ribbon onto the printing medium by using a thermal head. The explanation below relates to an example in which printing is performed on the labels attached to a mounting paper.

As shown in FIG. **1**, inside a printer casing **10**, a continuous body **3** of labels in which labels **1** are peelably attached to a mounting paper **2** is wound in a roll and held rotatably on a label feed reel **11**.

On the other hand, an ink ribbon **4** is wound on a ribbon feed reel **21** and a ribbon take-up reel **22**. A guide pole **23** and a ribbon conveying roller **24** are provided to establish the

conveying route of the ink ribbon **4**. The ribbon conveying roller **24** and the ribbon take-up reel **22** are driven and rotated with the stepping motor.

A platen roller **12** is driven and rotated by the stepping motor. As a result, the continuous body **3** of labels and the ink ribbon **4** are intermittently conveyed in the same direction and at the same speed. The mechanism for rotary driving the platen roller **12**, ribbon conveying roller **24**, and ribbon take-up reel **22** with the stepping motor will be referred to hereinbelow as "rotary drive mechanism".

A thermal head **13** has an assembly of a plurality of fine heat-generating bodies that generate heat when an electric current is passed therethrough. The thermal head is disposed opposite the platen roller **12** via the continuous body **3** of labels and the ink ribbon **4**. Printing is performed by applying a voltage and passing an electric current through these heat-generating bodies, thereby causing the heat-generating bodies to generate heat, and transferring the ink of the ink ribbon **4** onto the label **1**.

An input unit **40** includes a keyboard and is used to operate the printer. A control unit **50** comprises, for example, a CPU and software and controls the operation of each unit. A display unit **60** comprises an LCD panel for displaying an error message or the like and performs a variety of displays based on signals supplied from the control unit **50**. A power source unit **70** supplies power to each unit.

The printing operation of the printer shown in FIG. **1** will be described below. When the stepping motor rotates the platen roller **12** in a state in which the continuous body **3** of labels and the ink ribbon **4** are inserted between the platen roller **12** and the thermal head **13**, the continuous body **3** of labels and the ink ribbon **4** are intermittently conveyed from right to left, as shown in the figure. The operation of conveying the continuous body **3** of labels and the ink ribbon **4** is controlled by the control unit **50** based on the detection results of a label sensor **14**.

By supplying printing signals to the thermal head **13**, while thus intermittently conveying the continuous body **3** of labels and the ink ribbon **4**, the heat-generating bodies of the thermal head **13** are caused to generate heat, and printing is performed on the label **1**. The label **1** on which printing has been performed is discharged to the outside from a label discharge port. The mounting paper **2** to which individual labels **1** have been attached may be separated by providing a cutter **5** in the vicinity of the label discharge port and cutting the mounting paper **2** with the cutter **5**. The ink ribbon used for printing is conveyed with the ribbon conveying roller **24** and taken up on a ribbon take-up reel **22**.

FIG. **2** is a schematic drawing illustrating a rotary drive mechanism and a tension unit of the printer of one embodiment of the present invention. FIG. **2**A is a side view illustrating the left side surface of the printer. FIG. **2**B is a front view illustrating the label discharge side of the printer. The tension unit **31**, which represents a specific feature of the present embodiment, has a double pulley **32** and a tension pulley **33** that are disposed in contact with timing belts **20** and **30**, respectively, and rotated by following the movement thereof. These pulleys **32** and **33** are biased in the direction shown by an arrow in FIG. **2**. Some members in FIG. **2**B are omitted.

As shown in FIG. **2**, a stepping motor **15** rotates a motor shaft **15***a*, thereby driving the pulley **17***a* via the timing belt **16**. Teeth are formed on the inner circumference of the timing belt **16**, and teeth are formed on the outer circumference of the pulley **17***a* for engagement with the teeth of the timing belt **16**. The same is true for the timing belts and pulleys described hereinbelow.

A gear **17***b* is mounted on a shaft of the pulley **17***a* and the two rotate together. The gear **17***b* drives a first gear **18***a* of a double gear **18**. The double gear **18** has the first gear **18***a* and a second gear **18***b* and the two rotate together. The second gear **18***b* of the double gear **18** drives a gear **12***b* mounted on a platen roller shaft **12***a*. As a result, a drive power of the stepping motor **15** is transmitted to the platen roller **12** shaft **12***a* via the pulley **17***a*, gear **17***b*, and double gear **18**.

The first gear **18***a* of the double gear **18** drives a gear **19***a*. A pulley **19***b* is mounted on a shaft of the gear **19***a* and the two rotate together. The pulley **19***b* rotates a pulley **25***a* and a first pulley **32***a* of a double pulley **32** via a timing belt **20**. The double pulley **32** has the first pulley **32***a* and a second pulley **32***b* and the two rotate together.

A gear **25***b* is mounted on a shaft of the pulley **25***a* and the two rotate together. The gear **25***b* drives a gear **24***b* mounted on a ribbon conveying roller shaft **24***a*.

As a result, a drive power of the stepping motor **15** is transmitted to the ribbon conveying roller shaft **24***a* via the pulley **17***a*, gear **17***b*, double gear **18**, gear **19***a*, pulley **19***b*, pulley **25***a* and gear **25***b*, whereby the ribbon conveying roller **24** is rotated.

Moreover, the second pulley **32***b* of the double pulley **32** drives a pulley **22***b* mounted on a ribbon take-up reel shaft **22***a* via the timing belt **30**. As a result, a drive power of the stepping motor **15** is transmitted to the ribbon take-up reel shaft **22***a* via the pulley **17***a*, gear **17***b*, double gear **18**, gear **19***a*, pulley **19***b*, and double pulley **32**, whereby the ribbon take-up reel **22** is rotated. The ribbon take-up reel **22** can slide with respect to the ribbon take-up reel shaft **22***a*, and the ribbon tension does not rise above a set value, for example, even when the transportation of the ribbon is stopped.

Here, the double pulley **32** of the tension unit **31** applies tension to the timing belt **20**, and the tension pulley **33** applies tension to the timing belt **30**.

FIG. **3** shows a detailed structure of the tension unit. FIG. **3**A is a perspective view, and FIG. **3**B is a plan view (label discharge side). As shown in FIG. **3**, the tension unit **31** comprises a base material **34**, a double pulley support body **35** and a tension pulley support body **36** that are slidably mounted on the base material **34**, coil springs **37** and **38** serving as elastic members for biasing the support bodies **35** and **36** in a predetermined direction (to the left, as shown in the figure), the double pulley **32** that is rotatably supported by the double pulley support body **35** by using a screw **35***a*, the tension pulley **33** that is rotatably supported by the tension pulley support body **36** by using a screw **36***a* as well as screws **35***b* and **36***b* serving as fixing members for fixing the support bodies **35** and **36** to the base material **34**.

The screw **35***a* rotatably supports the double pulley **32** via a round hole provided in the double pulley support body **35** and an elongated hole provided in the base material **34**. The screw **35***b* is attached to the base material **34** via an elongated hole provided in the double pulley support body **35**. When the screw **35***b* is loosened, the double pulley support body **35** and the double pulley **32** can slide with respect to the base material **34** and are biased by the coil spring **37** to the left as shown in the figure.

The screw **36***a* rotatably supports the tension pulley **33** via a round hole provided in the tension pulley support body **36** and an elongated hole provided in the base material **34**. The screw **36***b* is attached to the base material **34** via an elongated hole provided in the tension pulley support body **36**. When the screw **36***b* is loosened, the tension pulley support body **36** and the tension pulley **33** can slide with respect to the base mate

rial **34** and are biased by the coil spring **38** to the left as shown in the figure.

The screws **35***b* and **36***b* are used to fix the positions of the double pulley **32** and tension pulley **33**, respectively. When the rotary drive mechanism is assembled, an operator moves the double pulley support body **35** and the tension pulley support body **36** in the direction shown by an arrow in FIG. **3**A (to the left) and then tightens the screws **35***b* and **36***b*. As a result, the operation of stretching the tension belts **20** and **30** (FIG. **2**) over the pulleys is facilitated.

After the rotary drive mechanism is assembled, the operator first loosens the screw **35***b*, and the double pulley **32** is moved to a position in which an appropriate tension is applied to the tension belt **20** (FIG. **2**) by the contraction force of the coil spring **37**. The position of the double pulley **32** is thereby automatically adjusted. Then, the operator tightens the screw **35***b*, whereby the double pulley **32** is fixed in an adequate position.

The operator then loosens the screw **36***b*, and the tension pulley **33** is moved to a position in which an appropriate tension is applied to the tension belt **30** (FIG. **2**) by the contraction force of the coil spring **38**. The position of the tension pulley **33** is thereby automatically adjusted. Then, the operator tightens the screw **36***b*, whereby the tension pulley **33** is fixed in an adequate position. With such a tension unit **31**, the rotary drive mechanism can be assembled or readjusted so that an adequate tension is applied to the tension belt, without using an adjustment tool.

The explanation hereinabove was conduced with respect to a two-stage belt tension mechanism for applying an adequate tension to two tension belts **20** and **30** shown in FIG. **2**, but the present invention is not limited to such a mechanism and a belt tension mechanism composing three or more stages can be also configured when three or more tension belts are used in the rotary drive mechanism. In this case, the number of pulleys and pulley support bodies may be set equal to the number of tension belts that apply tension.

Although the present invention has been described in relation to particular embodiments thereof, many other variations and modifications and other uses will become apparent to those skilled in the art. It is preferred, therefore, that the present invention be limited not by the specific disclosure herein, but only by the appended claims.

What is claimed is:

1. A printer comprising:

a printing medium feed reel that feeds a printing medium;

a ribbon feed reel that feeds an ink ribbon;

a platen roller that conveys the printing medium that is fed from said printing medium feed reel and the ink ribbon that is fed from said ribbon feed reel;

a thermal head that is disposed opposite said platen roller via the printing medium and the ink ribbon and performs printing by transferring ink of the ink ribbon onto the printing medium;

a ribbon conveying roller for conveying the ink ribbon that has been used for printing;

a ribbon take-up reel that takes up the ink ribbon that is conveyed by said ribbon conveying roller;

a motor that drives said platen roller;

a rotary drive mechanism that transmits a drive power of said motor to said ribbon conveying roller via at least a first belt and transmits a drive power of said motor to said ribbon take-up reel via at least the first belt and a second belt; and

a tension unit comprising a plurality of pulleys that are in contact at least with said first belt and second belt and rotate following the movement thereof, a plurality of elastic members that adjust positions of said plurality of pulleys so as to apply tension at least to said first belt and second belt and a plurality of fixing members that fix the positions of said plurality of pulleys.

2. The printer according to claim **1**, wherein said plurality of pulleys comprise: a first pulley that is in contact with said first belt, rotates following the movement thereof, and transmits the drive power transmitted from said first belt to said second belt; and a second pulley that is in contact with said second belt and rotates following the movement thereof.

3. The printer according to claim **1**, wherein said tension unit further comprises a base material and a plurality of support members that are slidably attached to said base material and rotatably support said plurality of pulleys; said plurality of elastic members comprise a plurality of coil springs that bias said plurality of support members in a predetermined direction; and said plurality of fixing members comprise a plurality of screws for fixing said plurality of support members to said base material.

* * * * *